

# CCSDS Implementations

Missions and Products



Draft 5  
August 2000

BNSC  
BRITISH NATIONAL SPACE CENTRE



# **CCSDS IMPLEMENTATIONS**

## **MISSIONS AND PRODUCTS**

**Draft 5  
August 2000**

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## Foreword

This report contains preliminary results of an ongoing survey of implementations conforming to Consultative Committee for Space Data Systems (CCSDS) Recommendations for Space Data System Standards. The information herein has been compiled by the CCSDS Secretariat. It is known to be incomplete and is intended only to provide an overview of the range of CCSDS-compatible implementations that have been developed around the world. Questions or comments about the contents of this report should be forwarded to the CCSDS Secretariat at the address on page ii.

At the time of this draft, the active Member and Observer Agencies of the CCSDS are

#### Member Agencies

- Agenzia Spaziale Italiana (ASI)/Italy.
- British National Space Centre (BNSC)/United Kingdom.
- Canadian Space Agency (CSA)/Canada.
- Centre National d'Etudes Spatiales (CNES)/France.
- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)/Germany.
- European Space Agency (ESA)/Europe.
- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- National Aeronautics and Space Administration (NASA)/USA.
- National Space Development Agency of Japan (NASDA)/Japan.
- Russian Space Agency (RSA)/Russian Federation.

#### Observer Agencies

- Austrian Space Agency (ASA)/Austria.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
- Centro Tecnico Aeroespacial (CTA)/Brazil.
- Chinese Academy of Space Technology (CAST)/China.
- Commonwealth Scientific and Industrial Research Organization (CSIRO)/Australia.
- Communications Research Laboratory (CRL)/Japan.
- Danish Space Research Institute (DSRI)/Denmark.
- European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)/Europe.
- European Telecommunications Satellite Organization (EUTELSAT)/Europe.
- Federal Service of Scientific, Technical & Cultural Affairs (FSST&CA)/Belgium.
- Hellenic National Space Committee (HNSC)/Greece.
- Indian Space Research Organization (ISRO)/India.
- Industry Canada/Communications Research Centre (CRC)/Canada.
- Institute of Space and Astronautical Science (ISAS)/Japan.
- Institute of Space Research (IKI)/Russian Federation.
- KFKI Research Institute for Particle & Nuclear Physics (KFKI)/Hungary.
- MIKOMTEK: CSIR (CSIR)/Republic of South Africa.
- Korea Aerospace Research Institute (KARI)/Korea.
- Ministry of Communications (MOC)/Israel.
- National Oceanic & Atmospheric Administration (NOAA)/USA.
- National Space Program Office (NSPO)/Taipei.
- Swedish Space Corporation (SSC)/Sweden.
- United States Geological Survey (USGS)/USA.

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# Introduction

The Consultative Committee for Space Data Systems (CCSDS) was formed in 1982 by the major space agencies of the world to provide a forum for discussion of common problems in the development and operation of space data systems. It is currently composed of nine member agencies, twenty-three observer agencies, and over 100 industrial associates.

CCSDS products are data- and information-system Recommendations intended to serve as baseline documents for the applicable standards of the participating agencies. Through its association with International Organization for Standardization (ISO) Technical Committee 20 (TC 20)/Subcommittee 13 (SC 13), the CCSDS has progressed the majority of its Recommendations to ISO International Standards.

The Recommendations of the CCSDS have been widely accepted by the international space community (space agencies and their partners). And although the CCSDS has been in existence for fewer than twenty years, internationally over 100 space missions using CCSDS-recommended data systems are either in operation or in active development, and an impressive infrastructure of CCSDS-compatible ground data systems has grown up to support those missions. At the same time, despite the relatively small size of the commercial market for space information systems, a strong base of international commercial developers has emerged, and today a wide variety of CCSDS-compatible products are available commercially.

This report presents an overview of known CCSDS-compatible missions and products. The lists of missions and products are the result of ongoing studies and are known to be incomplete. They will be updated as information on new missions and products comes to light. Current lists of CCSDS-compatible missions and products can be found on the Web at the following location:

<http://ccsds.gst.com/implementations/>

## CCSDS Missions

The table below lists missions known to be using CCSDS-recommended protocols. For the missions listed, CCSDS protocol use ranges from CCSDS Version 1 Transfer Frames for telemetry (early missions) to the full suite of conventional and/or Advanced Orbiting Systems (AOS) telemetry and telecommand protocols. Many of these missions also follow CCSDS Recommendations for data archiving, Space Link Extension (SLE) services, Time Code Formats, and Lossless Data Compression; the majority conform to CCSDS Recommendations for Radio Frequency and Modulation Systems.

The table is a product of a compilation of information gathered from several sources. In many cases, information was obtained from requirements, design, and interface-control documents prepared for individual missions. Reports and technical papers discussing use of CCSDS-recommended standards in particular missions, mission-related Web pages, and CCSDS agency reports to the CCSDS Management Council were also consulted. Where no documents were available, information was obtained through discussions with mission personnel.<sup>†</sup>

	Mission		Launch	Lead
1	ERS-1	ESA Remote Sensing Satellite 1	Jul-91	ESA
2	SAMPEX (SMEX-1)	Solar, Anomalous and Magnetospheric Particle Explorer (Small Explorer 1)	Jul-92	NASA/GSFC
3	EURECA	European Retrieval Carrier satellite	Jul-92	ESA
4	Spacelab-Deutsche 2		Apr-93	DLR
5	STRV-1 A/B	Space Technology Research Vehicles 1A/1B	Jun-94	BNSC
6	MIR-18 and follow-on missions		Various	NASA, RSA
7	ERS-2	ESA Remote Sensing Satellite 2	Apr-95	ESA
8	ISO	Infrared Space Observatory	Nov-95	ESA
9	Radarsat-1		Nov-95	CSA
10	SOHO	SOHO International Solar Terrestrial Physics Program (ISTP/COSTR)	Dec-95	ESA
11	ROSSI XTE	Rossi X-Ray Timing Explorer	Dec-95	NASA/GSFC
12	NEAR Shoemaker	Near Earth Asteroid Rendezvous/Shoemaker (Discovery Program 1)	Feb-96	NASA/APL
13	BeppoSAX	Satellite per Astronomia X ("Beppo" in honor of Giuseppe Occhialini)	Apr-96	ASI, NIVR, ESA
14	Cluster		Jun-96	ESA

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<sup>†</sup> (1) A list of acronyms appears at the end of the table.  
(2) Launch dates for future missions are volatile, and some of the projected dates shown in the table may no longer be consistent with current mission planning.  
(3) For telecommunications satellites, use of CCSDS protocols is generally limited to spacecraft command and control.

## ***CCSDS Implementations—Missions***

	Mission		Launch	Lead
15	TOMS-EP	The Total Ozone Mapping Spectrometer Earth Probe	Jul-96	NASA/GSFC
16	FAST (SMEX-2)	Fast Auroral Snapshot Explorer	Aug-96	NASA/GSFC
17	MGS	Mars Global Surveyor	Nov-96	NASA/JPL
18	MPF	Mars Pathfinder (Discovery Program 2)	Dec-96	NASA/JPL
19	ARIANE 5		Various	CNES
20	ACE	Advance Composition Explorer	Aug-97	NASA/GSFC
21	Hotbird-3	Telecommunications Satellite	Sep-97	ESA
22	Cassini/Huygens		Oct-97	NASA/JPL
23	TEAMSAT	Technology, science and Education experiments Added to MaqSAT	Oct-97	ESA
24	YES	Young Engineers' Satellite	Oct-97	ESA
25	ETS-VII	Engineering Test Satellite VII	Nov-97	NASDA
26	TRMM	Tropical Rainfall Measuring Mission	Nov-97	NASDA
27	Sirius 2		Nov-97	SSC
28	Lunar Prospector	Discovery Program 3	Jan-98	NASA/ARC
29	SNOE	Student Nitric Oxide Experiment	Feb-98	NASA/LASP
30	Hotbird-4	Telecommunications Satellite	Feb-98	ESA
31	NileSat 101	Telecommunications Satellite	Apr-98	NileSat
32	TRACE (SMEX-4)	Transition Region and Coronal Explorer (Small Explorer 4)	Apr-98	NASA/GSFC
33	Planet-B	a.k.a. NOZOMI	Jul-98	ISAS
34	Eutelsat W2	Telecommunications Satellite	Oct-98	Eutelsat
35	HotBird-5	Telecommunications Satellite	Oct-98	Eutelsat
36	DS-1 (NMP)	Deep Space 1 (New Millennium Program)	Oct-98	NASA/JPL
37	AfriStar	Telecommunications Satellite	Oct-98	WorldSpace
38	Mars Surveyor 1998 Orbiter	Mars Climate Orbiter	Dec-98	NASA/JPL
39	SWAS (SMEX-3)	Sub-millimeter Wave Astronomy Satellite (Small Explorer 3)	Dec-98	NASA/GSFC
40	International Space Station		Various	Multinational
41	ROCSAT-1		Jan-99	NSPO
42	Mars Surveyor 1998 Lander	Mars Polar Lander	Jan-99	NASA/JPL
43	Stardust	Stardust (Discovery Program 4)	Feb-99	NASA/JPL
44	Oersted		Feb-99	DSRI
45	WIRE (SMEX-5)	Wide-Field Infrared Explorer (Small Explorer 5)	Mar-99	NASA/GSFC
46	Eutelsat W3	Telecommunications Satellite	Apr-99	Eutelsat
47	Landsat-7	Landsat 7	Apr-99	NASA/GSFC
48	ABRIXAS	A BRoad-band Imaging X-ray All-sky Survey	Apr-99	DLR/GSOC

## ***CCSDS Implementations—Missions***

	Mission		Launch	Lead
49	QuikSCAT	Quick Scatterometer Mission	Jun-99	NASA/LASP
50	FUSE	Far Ultraviolet Spectroscopic Explorer	Jun-99	NASA/GSFC
51	Chandra X-Ray Observatory	Formerly, Advance X-Ray Astrophysics Facility-Imaging (AXAF)	Jul-99	NASA/MSFC
52	MTSAT	Multifunctional Transport Satellite	Aug-99	NASDA
53	Sesat	Siberian-European Satellite (Telecommunications Satellite)	Nov-99	Eutelsat-Intersputnik
54	Terra	Earth Observing System AM-1	Dec-99	NASA/GSFC
55	KOMPSAT-1	Korea Multi-purpose Satellite	Dec-99	KARI
56	XMM-Newton	X-ray Multimirror Mission	Dec-99	ESA
57	X-38	Crew Return Vehicle	Various	NASA
58	Hispasat 1C	Telecommunications Satellite	Feb-00	Hispasat S.A.
59	IMAGE (MIDEX-01)	Imager for Magnetopause-to-Aurora Global Exploration (Medium Class Explorer Program 1)	Mar-00	NASA/GSFC
60	AsiaStar	Telecommunications Satellite	Mar-00	WorldSpace
61	MTI	Multispectral Thermal Imager	Mar-00	DOE
62	Eutelsat W4	Telecommunications Satellite	May-00	Eutelsat
63	CHAMP	CHAllenging Microsatellite Payload	May-00	DLR/GSOC
64	QuickBird-1	Commercial remote sensing satellite	Jun-00	EarthWatch
65	OrbView-3	Commercial remote sensing satellite	Jun-00	ORBIMAGE
66	STENTOR	Satellite Technologique pour Experimenter des Nouvelles Techniques en ORbite	Jun-00	CNES
67	NEMO	Naval EarthMap Observer	Jun-00	NRL
68	STRV-1 C/D	Space Technology Research Vehicles 1C/1D	Jul-00	BNSC
69	ASTRA 2B	Telecommunications Satellite	Jul-00	SES/Astra
70	Proba	ESA Technology Demonstration Program	Jul-00	ESA
71	EO-1 (NMP-2)	Earth Observing-1 (New Millennium Program 2)	Aug-00	NASA/GSFC
72	VCL (ESSP-01)	Vegetation Canopy Lidar (Earth System Science Pathfinder 1)	Aug-00	NASA/GSFC
73	Eutelsat W1	Telecommunications Satellite	Aug-00	Eutelsat
74	Eurasiasat 1	Telecommunications Satellite	Sep-00	Eurasiasat
75	GP-B	Gravity Probe B; a.k.a. Relativity	Oct-00	NASA/GSFC
76	TIMED	Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics	Nov-00	NASA/APL
77	OrbView-4	Commercial remote sensing satellite	Nov-00	ORBIMAGE
78	MAP (MIDEX-02)	Microwave Anisotropic Probe (Medium Class Explorer 2)	Nov-00	NASA/GSFC
79	Aqua	Earth Observing System PM-1	Dec-00	NASA/GSFC
80	FedSat-1	Federation Satellite One	Dec-00	CSIRO
81	ADEOS-II	Advanced Earth Observing Satellite II	Dec-00	NASDA
82	NileSat 102	Telecommunications Satellite	2000	NileSat

## ***CCSDS Implementations—Missions***

	<b>Mission</b>		<b>Launch</b>	<b>Lead</b>
83	MITA	Microsatellite Italiano a Technologia Avanzata (Italian Advanced Technology Micro-satellite)	2000	ASI
84	ARTEMIS	Advanced Relay and Technology Mission Satellite	2000	ESA
85	Meteor-3M/SAGE III		2000	RSA, NASA
86	ASTRO-E		2000	ISAS
87	CATSAT (STEDI 3)	Cooperative Astrophysics and Technology SATellite (Student Explorer Demonstration Initiative 3)	2000	NASA/U of NH, Weber State U, U of Leicester
88	Cluster II		2000	ESA
89	MSG	Meteosat Second Generation	2000	ESA
90	JASON		2000	CNES
91	RESSAT	Telecommunications Satellite	2000	Eutelsat
92	SICRAL	Satellite Italiano di Comunicazioni Riservate ed ALLarmi (Telecommunications Satellite)	2000	Italian Ministry of Defense
93	HESSI (SMEX-6)	High Energy Solar Spectroscopic Imager	Jan-01	NASA/GSFC
94	Genesis (Discovery 5)	(formerly Suess-Urey)	Jan-01	NASA
95	Mars Surveyor 2001 Orbiter	a.k.a. Mars Chemical Mapper	Mar-01	NASA/JPL
96	Bird	Small Satellite Project	Mar-01	DLR/GSOC
97	INTEGRAL	International Gamma Ray Astrophysical Laboratory	Mar-01	ESA
98	ENVISAT-1		Jun-01	ESA
99	ICESat	Formerly EOS Laser Altimetry Mission (LAM) [sole instrument = Geoscience Laser Altimeter System (GLAS)]	Jul-01	NASA/GSFC
100	SIRTF	Space InfraRed Telescope Facility	Dec-01	NASA/JPL
101	Triana	Named for Rodrigo de Triana, Pinta lookout.	2001	NASA/SIO
102	Astra 1K	Telecommunications Satellite	2001	SES/Astra
103	Atlantic Bird 1	Telecommunications Satellite	2001	Eutelsat
104	GALEX (SMEX-7)	Galaxy Evolution Explorer	2001	NASA/GSFC
105	CHIPS (UNEX)	Cosmic Hot Interstellar Plasma Spectrometer (University-Class Explorer)	2001	NASA/SSL
106	IMEX (UNEX)	Inner Magnetosphere Explorer (University-Class Explorer)	2001	NASA/U of Minnesota
107	GRACE (ESSP)	Gravity Recovery and Climate Experiment (Earth System Science Pathfinder)	2001	NASA
108	ULDB	Ultra-Long Duration Balloon Program	2001	NASA/GSFC
109	MOST	Microvariability and Oscillations of STars	2001	CSA
110	Coriolis		Feb-02	NRL
111	CONTOUR (Discovery 6)	Comet Nucleus Tour	Jul-02	NASA/APL
112	SORCE	Solar Radiation and Climate Experiment	Jul-02	NASA/LASP
113	ETS-VIII	Engineering Test Satellite VIII	Aug-02	NASDA

## ***CCSDS Implementations—Missions***

	<b>Mission</b>		<b>Launch</b>	<b>Lead</b>
114	HTV	H-2 Transfer Vehicle	Aug-02	NASDA
115	Aura	EOS Chemistry Mission (EOS CHEM-1)	Dec-02	NASA/GSFC
116	DEMETER	Detection of Electro-Magnetic Emissions Transmitted from Earthquake Regions	2002	CNES
117	Radarsat-2		2002	CSA
118	Hotbird-6	Telecommunications Satellite	2002	Eutelsat
119	ALOS	Advanced Land Observation Satellite	2002	NASDA
120	MUSES-C	Sample return mission to the asteroid Nereus	2002	ISAS
121	MESSENGER	MErcury Surface, Space ENvironment, GGeochemistry and Ranging	2002	NASA/APL
122	USERS	Unmanned Space Experiment Recovery System	2002	NASDA
123	SMART-1	Small Mission for Advanced Research in Technology--ESA Horizon 2000	2002	ESA
124	Lunar-A		2002	ISAS
125	SMOS	Soil Moisture and Ocean Salinity	2002	ESA/CNES/SNP
126	METOP1	Meteorological Operational Satellite 1	Jan-03	EUMETSAT
127	Mars Express		Jun-03	ESA
128	NPOESS	National Polar-orbiting Operational Environmental Satellite System	Dec-03	NOAA, DoD
129	Picard		2003	CNES
130	ASTRO-F		2003	ISAS
131	Rosetta		2003	ESA
132	Selene		2003	NASDA
133	ATV	Automated Transfer Vehicle	2003	ESA
134	Europa Orbiter		2003	NASA/JPL
135	SWIFT (MIDEX 3)	Swift Gamma Ray Burst Explorer (Medium-class Explorer 3)	2003	NASA
136	PICASSO-CENA (ESSP-3)	Pathfinder Instruments For Cloud And Aero-sol Spaceborne Observations-Climatologie Etendue des Nuages et des Aerosols (Earth System Science Pathfinder 3)	2003	NASA/CNES
137	CloudSat (ESSP-4)	Earth System Science Pathfinder 4	2003	NASA
138	Deep Impact		Jan-04	NASA/U of Maryland
139	STEREO	Solar Terrestrial Relations Observatory	Jun-04	NASA/APL
140	MMS	Magnetospheric Multi-Scale	Dec-04	NASA
141	Solar-B		2004	ISAS
142	Pluto-Kuiper Express		2004	NASA/JPL
143	FAME (MIDEX 4)	Full-sky Astrometric Mapping Explorer (Medium-class Explorer 3)	2004	NASA
144	COROT	COndvection ROTation à Transits planétaires (COndvection ROTation and planetary Transits)	2004	CNES
145	PARASOL		2004	CNES

## ***CCSDS Implementations—Missions***

	<b>Mission</b>		<b>Launch</b>	<b>Lead</b>
146	MICROSCOPE	Micro Satellite à traînée Compensée pour l'Observation du Principe d'Équivalence	2004	CNES
147	Mars Netlander	Mars Network Lander	2005	FMI, ASI, CNES, DLR, IKI
148	GLAST	Gamma-ray Large Area Space Telescope	2005	NASA
149	Megha-Tropiques		2005	CNES/ISRO
150	SIM	Space Interferometry Mission	2006	NASA/JPL
151	Solar Probe		2007	NASA/JPL
152	FIRST	Far InfraRed and Submillimetre Telescope--ESA Horizon 2000 cornerstone 4 (CS4)	2007	ESA
153	Plank		2007	ESA
154	METOP2	Meteorological Operational Satellite 1	2008	EUMETSAT
155	Magnetospheric Constellation		2010	NASA

### ***Acronyms***

APL	Johns Hopkins University Applied Physics Laboratory (United States)
ASI	Agenzia Spaziale Italiana (Italy)
BNSC	British National Space Centre (United Kingdom)
CNES	Centre National d'Etudes Spatiales (France)
CSA	Canadian Space Agency (Canada)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DLR	Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)
DoD	Department of Defense (United States)
DOE	Department of Energy (United States)
DSRI	Danish Space Research Institute (Denmark)
ESA	European Space Agency (Europe)
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites (Europe)
FMI	Finnish Meteorological Institute
IKI	Institute of Space Research (Russian Federation)
ISAS	Institute of Space and Astronautical Science (Japan)
KARI	Korea Aerospace Research Institute
LASP	University of Colorado Laboratory for Atmospheric and Space Physics (United States)
NASA	National Aeronautics and Space Administration (United States)
NASDA	National Space Development Agency of Japan
NIVR	Netherlands Agency for Aerospace Programs
NOAA	National Oceanic & Atmospheric Administration (United States)
NRL	Naval Research Laboratory (United States)
NSPO	National Space Program Office (Taipei)
RSA	Russian Space Agency (Russian Federation)
SES	Société Européenne de Satellites
SIO	Scripps Institution of Oceanography (United States)
SNP	Spanish National Program
SSC	Swedish Space Corporation
SSS	Space Sciences Laboratory, University of California

# CCSDS: The Fleet



## CCSDS Compatible Products

The CCSDS Secretariat has undertaken to identify CCSDS-compatible commercial products, and research in this area is ongoing. The presence of a product in the following listing implies only that the Secretariat has evidence of that product's availability; in no way does it imply endorsement of that product by the CCSDS or any CCSDS member agency. In the same way, the absence of a product in the listing indicates only that the Secretariat does not have sufficient information to include it. Vendors who wish to inform the Secretariat of the existence of a CCSDS-compatible product should contact

Mr. Robert R. Stephens  
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Wheaton, MD 20902, USA

Phone: +1 301 949 0965  
E-mail: stephens@us.net

## Spacecraft Platforms

### NASA-Developed Carriers and Technology Transfer

#### **SMEX-lite**

The SMEX-lite platform was developed by NASA/Goddard Space Flight Center (GSFC). Its on-board data system is fully compliant with applicable CCSDS-recommended data standards, and it has been chosen as the platform for the Triana mission.

All the technology developed for SMEX-lite is available through technology transfer from GSFC. The point of contact for SMEX-lite technology transfer is

Wayne Hudson  
Goddard Space Flight Center  
Mailstop 750.0  
Greenbelt, MD 20771, USA

Phone: +1 301 286-8497  
Fax: +1 301 286-0301  
Wayne.R.Hudson.1@gsfc.nasa.gov

#### **Spartan Platforms**

Spartan platforms are CCSDS-compatible Shuttle-launched carriers developed at NASA/GSFC. The procedure for submitting proposals to fly instruments on Spartan platforms is outlined at <http://spartans.gsfc.nasa.gov/fly/index.html>.

**CCSDS Implementations—Products**  
*Spacecraft Platforms (continued)*

**Other Non-Commercial Manufacturers**

**Jet Propulsion Laboratory**

4800 Oak Grove Drive  
Pasadena, CA 91109-8099  
<http://www.jpl.nasa.gov/>

*Point of Contact:*

Merle McKenzie  
Phone: +1 818 354 2577  
Fax: +1 818 393-2754  
E-Mail: Merle.Mckenzie@jpl.nasa.gov

**Johns Hopkins University Applied Physics Laboratory**

Johns Hopkins Road  
Laurel, MD 20723-6006  
<http://www.jhuapl.edu/aplpage.htm>

*Point of Contact:*

Mr. Richard F. Conde  
Phone: +1 240 228 5000 8876  
Fax: +1 240 228 1093  
E-Mail: richard.conde@jhuapl.edu

The above organizations have extensive experience building and flying CCSDS-compatible spacecraft. While both have technology-transfer programs, it is unclear whether CCSDS-compatible spacecraft technology is currently available through those programs. However, JPL and APL are noted here along with GSFC as preeminent centers of expertise in CCSDS-related spacecraft technology.

## ***CCSDS Implementations—Products***

*Spacecraft Platforms (continued)*

### **Commercial Suppliers**

#### **Alcatel**

54 Rue La Boétie  
75008 Paris  
France  
Phone: +33 (0)1.40.76.10.10  
Fax: +33 (0)1.40.76.14.00  
<http://www.alcatel.com/telecom/space/Science/Jason.htm>

#### **Ball Aerospace**

1600 Commerce Street  
Boulder, Colorado 80301  
USA  
<http://www.ball.com/aerospace/comspace.html>

#### **Lockheed Martin Missiles & Space Company**

1111 Lockheed Martin Way  
Santa Cruz, CA 94086  
USA  
<http://lmms.external.lmco.com/>

#### **Matra Marconi Space**

Gunnels Wood Road  
Stevenage  
SG1 2AS  
Hertfordshire  
UK  
Phone: +44 01438 773698  
Fax: +44 01438 773069  
<http://www.matra-marconi-space.com/>

#### **Orbital Sciences Corporation**

Space Systems  
20301 Century Boulevard  
Germantown, Maryland 20874-1182  
USA  
Phone: +1 301 428 6620  
Fax: +1 301 428 6641  
[http://www.orbital.com/Gtown/docs/space/s23\\_95.html](http://www.orbital.com/Gtown/docs/space/s23_95.html)

#### **Space Innovations Limited**

The Paddock  
Hambridge Road  
Newbury  
Berks  
RG14 5TQ  
UK  
Phone: ++ 44 07000 SPACE IN or ++ 44 07000 772234  
Fax: ++ 44 1635 38785  
E-mail: [info@sil.com](mailto:info@sil.com)  
<http://www.sil.com/>

#### **Spectrum Astro, Inc.**

1440 N. Fiesta Blvd.  
Gilbert, AZ 85233  
USA  
<http://www.spectrumastro.com/>

#### **Swales Aerospace**

5050 Powder Mill Road  
Beltsville, MD 20705  
USA  
<http://www.swales.com/systems/eo-1/fs.html>

*Swales Aerospace Technical Point of Contact:*

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EO-1 Systems Engineer  
Phone: +1 301 902 4341  
E-mail: [mperry@swales.com](mailto:mperry@swales.com)

#### **TERMA Elektronik AS**

Hovmarken 4  
DK-8520 Lystrup  
Denmark  
Phone: +45 86 22 20 00  
Fax: +45 86 22 27 99  
E-mail: [terma.hq@terma.com](mailto:terma.hq@terma.com)  
<http://www.terma.com>

#### **TRW Space & Electronics Group**

One Space Park  
Redondo Beach, CA 90278  
[http://www.trw.com/prod\\_serv/space/index.html](http://www.trw.com/prod_serv/space/index.html)

# On-Board Systems and Components

## Technology Transfer

### **SMEX-lite technology transfer:**

Wayne Hudson  
Goddard Space Flight Center  
Mailstop 750.0  
Greenbelt, MD 20771  
Phone: +1 301 286-8497  
Fax: +1 301 286-0301  
E-mail: Wayne.R.Hudson.1@gsfc.nasa.gov

## Commercial Suppliers

### **T<sup>2</sup>C<sup>2</sup>™ (Telemetry, Timing, Command, & Control)**

**B.F. Goodrich Data Systems**  
6600 Gulton Court, N.E.  
Albuquerque, NM 87109, USA  
Phone: +1 505 345 9031  
Fax: +1 505 344 9879  
E-mail: [inquires@dsdabq.com](mailto:inquires@dsdabq.com)  
<http://www.dsdabq.com/>

### **ISC Bus Controller**

**General Dynamics Information Systems**  
8800 Queen Avenue South, BLCS1P  
Bloomington, MN, 55431, USA  
<http://www.cdev.com/products/prods.html>

#### *Point of Contact:*

Deb Newberry  
Phone: +1 612 921 6692  
Fax: +1 612 921 6823  
E-mail: [d.m.newberry@gd-is.com](mailto:d.m.newberry@gd-is.com)

### **Flight Software**

**The Hammers Company, Inc.**  
7474 Greenway Center Drive, Suite 710  
Greenbelt, MD 20770  
USA  
<http://www.hammers.com/>

Phone: +1 301 345 5300  
Fax: +1 301 345 6892  
E-mail: [shammers@hammers.com](mailto:shammers@hammers.com)

### **C&DH Systems**

**Litton Amecon**  
5115 Calcert Road  
College Park, MD 20740  
USA

#### *Litton Amecon Point of Contact:*

Larry Linton  
EO-1 Systems Engineer  
Phone: +1 301 454 9232  
E-mail: [larry\\_linton@amecon.com](mailto:larry_linton@amecon.com)

# **CCSDS Implementations—Products**

## **On-Board Systems and Components—Commercial Suppliers (continued)**

### **Flight Software**

#### **Microtel**

Jerry Hengemihle  
111 Centerway  
Greenbelt, MD 20770  
USA  
+1 301 646 4921  
<http://www.microtel-md.com/>

### **Data Handling Systems**

#### **Space Innovations Limited**

The Paddock  
Hambridge Road  
Newbury  
Berks  
RG14 5TQ  
UK

Phone: +44 07000 SPACE IN or +44 07000 772234  
Fax: +44 1635 38785  
Telex: 846118 SATINT(G)  
E-mail: [info@sil.com](mailto:info@sil.com)  
<http://www.sil.com/subsys/dhs/title.htm>

### **Remote Interface Unit**

### **Central Electronics Unit**

#### **Orbital Sciences Corporation**

Space Systems  
20301 Century Boulevard  
Germantown, Maryland 20874-1182, USA

Phone: +1 301 428 6620  
Fax: +1 301 428 6641  
[http://www.orbital.com/Gtown/docs/space/s23\\_95.html](http://www.orbital.com/Gtown/docs/space/s23_95.html)

### **C&DH Systems**

#### **Spectrum Astro, Inc.**

1440 N. Fiesta Blvd.  
Gilbert, AZ 85233, USA  
<http://www.spectrumastro.com/Products/C&DH.asp>

### **On-Board Software**

### **Software Validation Facilities**

#### **TERMA Elektronik AS**

Hovmarken 4  
DK-8520 Lystrup  
Denmark  
Phone: +45 86 22 20 00  
Fax: +45 86 22 27 99  
E-mail: [terma.hq@terma.com](mailto:terma.hq@terma.com)  
<http://www.terma.com>

### **Satellite Subsystems**

#### **Samsung Aerospace Industries, Ltd.**

15th Fl., Samsung-YokSam Bldg.  
647-9, YokSam-Dong, Kangnam-Gu,  
Seoul, Korea 135-080

Phone: +82 2 3467 7000  
Fax: +82 2 3467 7080  
<http://www.samsungcamera.com/product/director.html>

### **Command & Telemetry Module**

### **VME Processor**

#### **Southwest Research Institute (SwRI)**

SwRI Main Office  
6220 Culebra Road  
P.O. Drawer 28510  
San Antonio, Texas 78228-0510, USA  
Phone: +1 210 684 5111  
Telex 244846  
<http://www.SwRI.org/default.htm>

*SwRI Point of Contact:*

Mike McLellan  
Phone: +1 210 522 3360  
E-mail: [MMcLellan@swri.edu](mailto:MMcLellan@swri.edu)

# Space Qualified ASICs

## Imaging/Time Distribution

### Interuniversity Microelectronics Center (IMEC)

Kapeldreef 75  
B-3001 Leuven  
Belgium  
<http://www.imec.be/>

Phone: +32 (0)16/28.12.11  
Fax: +32 (0)16/22.94.00  
E-mail: [info@imec.be](mailto:info@imec.be)

### Reed-Solomon Encoder AOS Packet Telemetry Chip Set Virtual Channel Assembler and Multiplexer Packet Telecommand Decoder

**ESA/European Space Technology Centre**  
Keplerlaan-1, Box 299  
2200 A.G. Noordwijk  
The Netherlands  
<http://www.estec.esa.nl/>

*Point of Contact:*

Sandi Habinc  
Phone: +31 71 565 4722  
Fax: +31 71 565 4295  
E-mail: [sandi@ws.estec.esa.nl](mailto:sandi@ws.estec.esa.nl)

## AOS Frame Formatter

**Lockheed Martin Missiles and Space**  
Sunnyvale, CA 94086  
<http://lmms.external.lmco.com/>

*Point of Contact:*

Vince Lopez  
Phone: +1 408 756 9337  
E-mail: [vince.lopez@LMSO.com](mailto:vince.lopez@LMSO.com)

### Reed-Solomon Encoder Lossless Data Compression Encoder Packetizer (under development)

**Microelectronics Research Center**  
University of New Mexico  
801 University SE, #206  
Albuquerque, NM 87106  
<http://www.mrc.unm.edu/>

*Point of Contact:*

Dr. Gary Maki, Director  
Microelectronics Research Center  
Phone: +1 505 272 7040  
E-mail: [hostmaster@mrc.unm.edu](mailto:hostmaster@mrc.unm.edu)

### Packet Telecommand Decoder Virtual Channel Assembler and Multiplexer AOS Frame Formatter

**Mitsubishi Electric Corporation**  
2-2-3 Marunouchi, Chiyoda-ku  
Tokyo, Japan 100  
[http://www.mitsubishi.com/ghp\\_japan/home.html](http://www.mitsubishi.com/ghp_japan/home.html)

*Point of Contact:*

NASDA CCSDS Secretariat  
Tsukuba Space Center  
2-1-1, Sengen  
Tsukuba-city, Ibaraki 305-8505  
Japan  
Phone: +81 298 59 2978  
Fax: +81 298 50 1916  
E-mail: [NASDA.CCSDS@nasda.go.jp](mailto:NASDA.CCSDS@nasda.go.jp)

# Ground Systems and Components

## Commercial Ground Networks

### **Multi-user Satellite Commercial Ground Network**

#### **Universal Space Network (USN)**

<http://www.uspacenetwork.com/>

*Point of contact:*

Tom Pirrone

Phone: +1 215 328 9130

E-mail: [tpirrone@uspacenet.com](mailto:tpirrone@uspacenet.com)

### **DataLynx Satellite Command, Control, and Communications Network**

#### **DataLynx**

AlliedSignal Technical Services Corporation

7000 Columbia Gateway Drive

Columbia, Maryland 21046

Phone: +1 800 638 6417 x7700

Fax: +1 410 964 7300

E-mail: [DataLynx@AlliedSignal.com](mailto:DataLynx@AlliedSignal.com)

<http://www.datalynx.alliedsignal.com/>

## *CCSDS Implementations—Products*

*Ground Systems and Components (continued)*

## Telemetry and Command Data Processing

### *Technology Transfer*

The Microelectronics Systems Branch (MSB) at NASA/Goddard Space Flight Center has developed a variety of CCSDS-compatible hardware and software that is available through technology transfer. The technology transfer contact at GSFC for MSB-developed technology is:

Evette Brown-Conwell  
Code 702  
Office of Commercial Programs  
NASA Goddard Space Flight Center  
Greenbelt, MD 20771  
USA

Phone: +1 301 286 0561  
E-mail: econwell@pop500.gsfc.nasa.gov

### *Commercial Suppliers*

#### **Forward Error Correction Products**

##### **Advanced Hardware Architectures, Inc.**

2365 NE Hopkins Court  
Pullman, WA 99163-5601, USA  
<http://www.aha.com/>

Phone: +1 509 334 1000  
Fax: +1 509 334 9000  
E-mail: sales@aha.com

##### **Reed-Solomon Compiler**

##### **Altera Corporation**

101 Innovation Drive  
San Jose, CA 95134, USA  
<http://www.altera.com/>

Phone: +1 888 325 8372  
Fax: +1 408 544 6403  
E-mail: lit\_req@altera.com

##### **Data Multiplexer/Demultiplexer System**

##### **Apogee Labs, Inc.**

414 Industrial Drive  
North Wales, PA 19454, USA  
<http://www.apogeelabs.com>

##### *Point of Contact:*

David Grebe  
Phone: +1 215 699 2060  
Fax: +1 215 699 2061  
E-mail: aligrebe@pond.com

#### **Telemetry Processing**

##### **ASRC Aerospace Corp.**

6411 Ivy Lane, Suite 610  
Greenbelt, MD 20770, USA  
<http://www.akspace.com/>

Phone: +1 301 345 4500  
Fax: +1 301 345 9274  
E-mail: busdev@akspace.com

# **CCSDS Implementations—Products**

**Ground Systems and Components—Telemetry and Command Data Processing (continued)**

## **Satellite Ground Systems and Components**

### **Avtec Systems, Inc.**

10530 Rosehaven Street, Suite 300  
Fairfax, Virginia 22030, USA  
<http://www.avtec.com/Avtec/>

#### *Point of Contact:*

David Hahn  
Marketing Manager, Telemetry Products  
Phone: +1 703 273 2211  
Fax: +1 703 273 1313  
E-mail: [dhahn@avtec.com](mailto:dhahn@avtec.com)

## **Tlm Data Return Link Processor (PCI card)**

### **Aydin Telemetry**

47 Friends Lane  
Newton, PA 18940-1328 , USA  
<http://www.aydin.com/>

#### *Point of Contact:*

Richard Margraff  
Sales Manager, Ground Telemetry Products  
Phone: +1 215 497 8000  
Fax: +1 215 968 3214  
E-mail: [margrar@aydin.com](mailto:margrar@aydin.com)

## **Desktop Satellite Data Processor**

### **Century Computing, Inc.**

8101 Sandy Spring Rd.  
Laurel, MD 20707, USA  
<http://www.cen.com/dsp/dsdp2.html>

#### *Point of Contact:*

Charlie Shaw  
Phone: +1 301 953 3330  
Fax: +1 301 953 2368  
E-mail: [cshaw@centurycomputing.co](mailto:cshaw@centurycomputing.co)

## **Command and Control Toolkit**

### **Command and Control Technologies Corporation**

Florida/NASA Business Center  
1311 N. U.S. Hwy 1, Suite 129  
Titusville, FL 32796, USA

Phone: +1 407 383 5282  
Fax: +1 407 383 5096  
E-mail: [info@cctcorp.com](mailto:info@cctcorp.com)

## **OPEN 2000 Ground Station**

### **Datron Systems Incorporated**

3030 Enterprise Court  
Vista, CA 92083, USA  
<http://www.dtsi.com/h2rec.html>

Phone: +1 760 734 5454  
Fax: +1 760 734 5450 Telemetry/Command

## **Ground Segment Spacecraft Command Interface Software**

### **ESYS Limited**

1 Stoke Road  
Guildford, Surrey  
GU1 4HW  
UK  
<http://www.esys.co.uk/>

Phone: +44 (0)1483 304545  
Fax: +44 (0)1483 303878  
E-mail: [linda@esys.co.uk](mailto:linda@esys.co.uk)

## **Telemetry Data Processing**

### **GATS, Inc.**

11864 Canon Blvd., Suite 101  
Newport News, VA 23606, USA  
<http://www.gats-inc.com/>

Phone: +1 757 873 5920  
Fax: +1 757 873 5924  
E-mail: [gats@gats-inc.com](mailto:gats@gats-inc.com)

## **VME Bus AOS Telemetry Processor Board/PC-based System**

### **GDP Space Systems**

A Division of Delta Information Systems  
300 Welsh Road, Bldg. 3  
Horsham, PA 19044, USA  
<http://www.gdpspace.com/>

Phone: +1 215 657 5270 ext. 119  
Fax: +1 215 657 5273  
E-mail: [snydered@gdpspace.com](mailto:snydered@gdpspace.com)

## **CCSDS Implementations—Products**

*Ground Systems and Components—Telemetry and Command Data Processing (continued)*

### **Integrated Test and Operations System (ITOS)**

**The Hammers Company, Inc.**  
7474 Greenway Center Drive, Suite 710  
Greenbelt, MD 20770, USA  
<http://www.hammers.com/>

Phone: +1 301 345 5300  
Fax: +1 301 345 6892  
E-mail: shammers@hammers.com

### **Direct Ingestion Server**

**Kongsberg Spacetec**  
Prestvannveien 38  
N-9292 Tromsø  
Norway  
[http://www.spacetec.no/docs/pro\\_bro.htm](http://www.spacetec.no/docs/pro_bro.htm)

Phone: +47 77 66 08 00  
Fax: +47 77 65 58 59  
E-mail: marketing@spacetec.no

### **Magali Telemetry Workstation Software**

**High Tech Systems**  
Ergopolis, Route d'Elne  
66200 Montescot  
France  
<http://www.magali.com/magalie2.htm>

Phone: +33 4 68 37 36 35  
Fax: +33 4 68 37 36 34  
E-mail: magali@htsys.com

### **Telemetry/Telecommand Processing System**

**L3 Communications Telemetry & Instrumentation**  
15378 Avenue of Science  
San Diego, CA 92128, USA  
<http://www.ti.l-3com.com/html/impact.htm>

Phone: +1 800 351 8483, ext. 70  
E-mail: sales-mktg@ti.L-3Com.com

### **Telecommand Products**

**I B + M A de Lande Long Software & Consultancy**  
Im Weingarten 13  
D-64342 Seeheim  
Germany  
<http://www.delandelong.com>

Phone: +49 6151 54926  
Fax: +49 6151 595701  
E-mail: contact@delandelong.com

### **CCSDS-ESA Packet TM/TC Workstation (CWS)**

**Satellite Services B.V.**  
Scheepmakerstraat 40  
2222 AC Katwijk aan Zee  
The Netherlands  
<http://www.satserv.nl/general/index.htm>

Phone: +31-(0)71-402-8120  
Fax: +31-(0)71-402-7934  
E-mail: info@satserv.nl

### **CCSDS Uplink/Downlink Interface Card Reed-Solomon Error Correction (RSEC) Chip**

**SBS Berg Telemetry Systems**  
2250 Camino Vida Roble  
Carlsbad, CA 92009 , USA  
<http://www.sbs-bergsys.com>

Phone: +1 760 438 5656  
Fax: +1 760 438 0056  
E-mail: info@bergsys.com

### **TNX/4 LEO Ground Terminal Telemetry Processing Software**

**Integral Systems**  
5000 Philadelphia Way, Suite A  
Lanham, MD 20706-4417, USA  
<http://www.integ.com>

E-mail: epoch@integral.com

## **CCSDS Implementations—Products**

**Ground Systems and Components—Telemetry and Command Data Processing (continued)**

### **Monitor and Control Software**

#### **Science Systems (Space) Ltd**

Clothier Road  
Bristol  
BS4 5SS  
UK  
<http://www.scisys.co.uk/company/divisions/space.htm>  
Phone: +44 (0) 117 971 7251  
Fax: +44 (0) 117 971 1125  
E-mail: space.marketing@scisys.co.uk

#### **Open System/Integrated Control Center™**

#### **Software Technology, Inc.**

1225 Evans Road  
Melbourne, Florida 32904-2314  
USA  
<http://www.mlb.sticomet.com/>  
Phone: +1 800 586 2200  
Phone: +1 407 723 3999  
Fax: +1 407 676 4510  
E-mail: [jon@xgnt.com](mailto:jon@xgnt.com)

### **Satellite Ground Segment**

#### **Space Applications Services**

Leuvensesteenweg 325  
B-1932 Zaventem  
Belgium  
<http://www.sas.be/>  
Phone: +32(0)2 721 54 84  
Fax: +32(0)2 721 54 44  
E-mail: [marketing@sas.be](mailto:marketing@sas.be)

### **Ground Station Telemetry and Command Data Processing System**

#### **TRW Components International**

19951 Mariner Avenue  
Torrance, CA 90503, USA  
<http://www.trwci.com/Ground.html>  
Phone: +1 310 214 5500  
E-mail: [marketing@trwci.com](mailto:marketing@trwci.com)

### **Telemetry and Telecommand Systems**

#### **TSI Telsys, Inc.**

7100 Columbia Gateway Drive, Suite 150  
Columbia, MD 21045, USA  
<http://www.tsi-telsys.com/products/products.htm>

Phone: +1 410 872 3900  
Phone: +1 800 346 3282  
Fax: +1 410-872-3901  
E-mail: [info@tsi-telsys.com](mailto:info@tsi-telsys.com)

### **PC-Based Telemetry Server Suite**

#### **Voss Scientific**

418 Washington St., SE  
Albuquerque, NM 87108, USA  
<http://www.vosssci.com/vs609.html>

Phone: +1 505 255 4201  
Fax: +1 505 255 4294  
E-mail: [vosssci@vosssci.com](mailto:vosssci@vosssci.com)

### **Parallel Integrated Frame Synchronizer (PIFS) Chip Service Processor (SP) Chip Return Link Processor Board**

#### *Point of Contact:*

Glenn Unger  
Code 750  
Office of Commercial Programs  
NASA Goddard Space Flight Center  
Greenbelt, MD 20771

Phone: +1 301 286 5979  
E-mail: [glenn.l.unger.1@gsfc.nasa.gov](mailto:glenn.l.unger.1@gsfc.nasa.gov)

### **Telemetry Processing Cards/Systems**

#### **Acroamatics, Inc.**

70 South Kellogg Ave., Suite A  
Goleta, CA 93117, USA  
<http://www.acroam.com/index.html>

Phone: +1 805 967 9909  
Fax: +1 805 967 8375  
E-mail: [jefj@acroam.com](mailto:jefj@acroam.com)

*CCSDS Implementations: Missions and Products*

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